

C H R O N I C

M I L I A R Y T U B E R C U L O S I S

A REVIEW OF THE LITERATURE WITH A DISCUSSION
BASED ON FINDINGS IN THE TEN CASES PRESENTED.

by

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INTRODUCTION

1.

In general practice the opportunity of studying tuberculosis is limited to notifying the disease after which the cases are seldom seen unless they are fortunate enough to recover. The presence of a large and well equipped tuberculosis sanatorium within two miles of my practice first aroused an interest in the subject which was further stimulated by an invitation to attend the clinics and study any interesting cases.

If any current textbook on Medicine is opened at the section devoted to tuberculosis, a small portion of it may be assigned to Miliary Tuberculosis which is described as an acute malady, chiefly confined to children and invariably fatal within two weeks to three months. Recently, however, with the improvement in radiological technique, it has been possible to recognise the existence of a miliary tuberculosis which runs a subacute or chronic course and may even be arrested.

Until a year ago, only one or two isolated cases were reported in British literature where the chronic type was described as an extreme rarity. On the continent and in America, this was not so. As early as 1873, Burkart(1) gave a detailed report of four cases, the post-mortem findings in these suggesting that the miliary tuberculosis had been present for a considerable time before death. Even before this

the existence of a chronic form had been suggested by Waller in 1845 and Wunderlich in 1860. Since these reports were made prior to the identification of Koch's bacillus as the cause of tuberculosis, they cannot carry much weight.

In 1906 Longcope(2) published a report on eight cases which might be termed chronic. Adami and Nichols discussed chronic military tuberculosis as a pathological entity well known to pathologists in 1910. During the following fourteen years, isolated cases were described by Leopold(31), von Muralt(32), Kern(33), Cohn(4), Kahn(34) and others; Cohn's case is perhaps, of most interest - it was that of a girl whose spleen was removed on account of a supposed Banti's disease; it was found to be riddled with military tubercles as was the peritoneal surface of the liver. An X-ray of the lungs showed a typical military stippling. The patient recovered and the X-ray appearances were normal five years later.

Opie(7) in 1922 when discussing his healed cases pointed out that 'a grave infection must have existed at some previous time; even if there was no history of corresponding symptoms, there was doubtless at some period, grave danger of death from tuberculosis!'

We are indebted to Burnard and Saye(5) for the first full description of the 'granulie froide' as they termed it. They had nine cases where the diagnosis was based on radiological findings; two died from meningitis when diagnosis was confirmed and the remainder with one exception, were improving. It is a condition, they said, which runs a slow irregular

course, was resistant to treatment, with physical signs almost exclusively those of an apical fibrosis and an X-ray picture of fine nodules scattered over the lung fields.

The first reference in British literature was made by Denham and Skavlam(6). They pointed out that evidence of healed miliary tuberculosis was not infrequently found but that few patients had shown signs of any serious chest trouble. Then Preston and Jeaffreson(8) in 1925 reported a case where radiographic and sputum evidence of miliary tuberculosis was found in association von Mickulicz's disease; there was apparent recovery. Burton Wood in 1933 followed the course of a boy whose lungs showed a typical miliary stippling at the age of seven; at sixteen a chronic fibrocaseous disease was present in both lungs and tubercle bacilli were present only after cavitation had occurred. He(9,10) also tabulated the clinical and radiological differences between the acute and chronic forms.

With the advances in radiological technique, more cases were being discovered. In 1934, the British Medical Journal(11) made it the subject of a leading article; a discussion on the conclusions of American and Continental writers was made; the ^{ADE}in_{an}adequateness of the present name was remarked upon and the clumsy but more accurate 'Chronic Disseminated Haematogenous Tuberculosis with pulmonary Localisation' was suggested. Deaner(12) reported a case in association with erythema nodosum where the prognosis appeared very bad but the patient was well seven months later; he

concluded that this patient's fate had hung in the balance and depended upon the mechanism of defence or resistance, i.e. whether it broke down to end with meningitis or progressed to fibrosis and calcification. Maxwell(35) described a case of a nurse with cervical adenitis and typical miliary stippling and Pel-Ebstein type of pyrexia; fifteen months after admission, the skiagram showed normal lungs with no scarring.

These were more or less isolated references to what was considered a rare and ill-defined complaint and few reliable conclusions could be drawn from them. In 1937, Fish(13) wrote a very comprehensive article on the disease as it affected children; he had ten cases to describe of which four recovered. In the same year Hoyle and Vaizey(14) compiled a monograph in which they had collected all the authentic cases in the literature, adding ten of their own. They discussed the present confusion as to the pathogenesis and summarised their own conclusions.

At present there are twenty seven cases reported in British literature and about one hundred and fifty in the medical press of other countries. It appears to be still somewhat uncommon.

In this thesis it is proposed to present ten other cases; to discuss the probable aetiology and pathogenesis of the condition and to make special reference to those cases who survive and their reasons for their doing so.

It has been suggested that Chronic Miliary Tuberculosis is a name which does not adequately describe the condition under discussion. Confusion as to its pathogenesis is largely responsible .

It may be briefly defined as a disease tending to run a prolonged course, characterised by the presence of multiple discrete lesions evenly distributed throughout the lungs and caused by the tubercle bacillus.

No age appears to be exempt but is most frequent between the ages of eleven and thirty (analysis of one hundred and twenty cases of Hoyle and Vaizey). The sexes are attacked in equal proportions and it occurs in the well-nourished as often as in the weakly and decrepit. Burnard and Saye(15) have seen several members of one family affected.

At the present stage of our knowledge we are unable to foretell who is likely to become a victim of miliary tuberculosis. The role of resistance, immunity and allergy, which at present cannot be estimated, must become more assessable. There does not appear to be any essential difference between the acute and chronic types, the fate of the victim depending on his mechanism of humoral defence or resistance. The majority of published cases of the chronic type give evidence of extrapulmonary tuberculosis and , in fact, the miliary condition has frequently been discovered only in the course of a

routine examination; in other words, the resistance of this type is strong and the lung lesions would never have been discovered, had not the more progressive tuberculous lesion manifested itself. It is more than likely that many cases of chronic military tuberculosis have never come to the notice of the physician. Saye, in the X-ray examination of over five hundred apparently healthy students in Barcelona, found a surprisingly high percentage showing evidence of healed and hitherto unsuspected military tuberculosis.

So far it is permissible to postulate that the subjects of existing tuberculosis are more likely to develop military tuberculosis than others; this is more probable when exanthemata, specific fevers or surgical operations (especially on the genito-urinary system) complicate it. How is this lowering of immunity or resistance accomplished to allow of the successful military implantation of the germ, for it has been frequently demonstrated in animals as well as in humans that the mere blood dissemination, in sensitised subjects, is insufficient to produce a military tuberculosis. (44, 45)

Allergy plays an important, if indefinite, part in the recovery or otherwise of military tuberculosis. Rich(16) adduces evidence to show the profound effect of the allergic state on the type of military tuberculosis resulting. The soft, rapidly caseating nodule results from a large invasion in a highly allergic host whereas the hard nodule is found in

the less allergic subject. Pottinger(17) suggests that, when the tubercle bacillus enters the body, it irritates the local cells which attempt to localise it - this is a non-specific defensive effort. After the cells have been sensitised, allergy of a varying degree, from slight hyperaemia to a severe exudation with tissue necrosis, may be met when the host receives a further enoculation of the bacilli. The degree of allergy depends upon the dose and virulence of the infection and the reaction of the host. The great variations found in the course of military tuberculosis could be accounted for, to some degree, by such an hypothesis. Fish(13) studying military tubercles at varying stages post-mortem, found that pathologically they were similar, but the individual reaction differed. Aschoff, in his 1924 Janeway Lectures, stressed the fact that the formation of military is, in itself, an expression of immunity; otherwise death from tuberculous septicaemia would be the outcome of every case of haematogenous dissemination. Burton Wood(18) suggested that the military stippling seen in the X-ray might be an epituberculous manifestation in those cases which recover. A coarser type of stippling is sometimes seen and exudative phenomena are not infrequent in chronic military cases. But these findings are by no means constant; since the opacities may remain for a considerable time and may even calcify, a benign exudation could not be responsible for the radiological appearance in all cases. Nicaud(19) was able to produce chronic military tuberculosis in rabbits by the repeated inoculation

of dead bacilli and he considered that a similar happening might account for the appearances found in those humans who recover; he does not explain how the bacilli could survive intact to appear in the sputum or gastric lavage and to be found in sections at autopsy. Correlating Wood's and Nicaud's observations, Fish(13) suggested that the stippling seen in those cases which recover, might conceivably be a local allergic reaction produced by tubercle bacilli which had been killed after haematogenous implantation.

The method of spread of the infection is the subject of some divergence of opinion. Is it blood borne or lymphogenous or a combination of both?

It is perhaps relevant at this stage to discuss the results of primary infection. The mouth provides the common portal of entry; from there it may travel to the lungs by inhalation or to the alimentary tract by ingestion. The former is considered to be the more frequent. On examining the X-ray of an affected person, a small dense shadow (Gohn's or Assman's focus) may be seen in the lung fields with a slightly increased broncho-vascular marking radiating to the hilum where there is an area of denser shadow representing a lymph gland. This is commonly known as Ranke's primary complex.

Prior to Ranke's investigations (20) in 1916, it was assumed that if the tubercle bacillus entered the blood stream, the result was death. He suggested that a haematogenous dissemination was a fundamental

feature of tuberculosis. There had always been some difficulty in accounting for the focal lesions which were not fatal and Ranke's concept of the three phases of tuberculosis, using the three stages of syphilis as a parallel, received considerable attention and were in part accepted. The proof, however, is lacking - namely that a tuberculous bacillaemia is a constant sequel to the primary infection; this is Ranke's second stage. He suggested that the secondary infection might be single or recurrent, massive or minimal, continuous or intermittent. This was an attractive hypothesis and could account for many unexplained features of the disease. It has been suggested that chronic miliary tuberculosis is a prolonged secondary stage of Ranke. The varying degree of chronicity, the tendency to recurrence and the frequency of extrapulmonary lesions are evidence in support of this.

To return to the results of primary infection. When the infection reaches the root glands, one of four things may happen(Wood10). It may be overcome in which case it leads to a relative immunity which lasts until adolescence; secondly there may be reinfection with the production of local disease; thirdly and fourthly, changes may take place in the hilum glands which lead to caseation and ulceration resulting in a tuberculous bacillaemia; this may be minimal giving rise to exudative lesions or massive when a miliary condition arises. Therefore the fate of the individual depends upon his ability to overcome the infection at the root glands; it must also

depend upon the amount of caseation and ulceration, the size of the hilar glands and their relation to the adjacent blood vessels. Thence the infection may spread to the tracheo-bronchial and paratracheal glands via the lymph stream. From the paratracheal glands, it may be presumed that there would be little difficulty for it to reach the thoracic or main right lymph duct and into the pulmonary blood stream. That this is what happens in a number of cases, at least, is borne out by the marked widening of the upper mediastinal shadow in the skiagram of the majority of chronic miliary subjects.

As early as 1882 Weigert(21) showed that miliary tuberculosis resulted from the ulceration of an intimal lesion into the blood stream. The theory was attacked but was demonstrable in a large number of cases. Hartwich(22) found a penetrating vascular lesion in 90% of his cases. Stahlein(23) in 397 autopsies of acute miliary disease found intimal tubercles; 55% were in the pulmonary veins, 33% in the thoracic duct and 8% elsewhere. It has been shown that the tubercle bacillus tends to attack the intimal coat of the vascular system. It may arrive there by contact with tuberculous blood or via the lymph stream but there is no evidence to suggest that a caseating lymph gland may ulcerate into a blood vessel, especially since there appears to be a great tendency for a proliferative endarteritis and thrombosis to arise in the region of a tubercle. If the intimal lesion is in the pulmonary arteries, a miliary lung lesion results, or if in the systemic

vessels a generalised form appears. This mere dissemination is not sufficient, for the morbid soil must have been previously prepared.

Fish(24) had the opportunity of examining at autopsy military tubercles in all stages from the acute to the calcified. He was able to demonstrate tubercle bacilli in them; they were discrete in the interstitial tissue and not in any definite relation to the bronchial tree. Frequently there were remote lesions demonstrable and the liver and spleen were found studded with tubercles. His findings considerably strengthen the theory of the haematogenous spread from an original focus.

Assman, Schurmann(36), Burnard and Saye and others contend that the spread in a number of cases is lymphogenous throughout. The chronicity of the disease corresponded well with that of tuberculous affections of the lymphatic system in general. This would involve a retrograde spread of the infection throughout the lung; such has been shown to be possible and an analogy is drawn to the retrograde spread of certain neoplasms which produce a cancerous lymphangitis leaving nodular foci along its track. Burnard and Saye(25) contend that a lymphatic spread is very common in the very chronic and calcifying cases but admit that the acute type is always blood borne. Such a method of spread could account for the cases in which only one lung or a part of it are affected. The X-ray appearances give a military stippling which is not so discrete or diffuse and

which is associated with a reticular lymphangitis in relation to the bronchial tree. It certainly does not correspond with the generally accepted picture nor does it fit in with any of my own cases. Lindau(37) suggests that this appearance is in keeping with a generalised disease of the lymphatic system - benign lymphogranuloma which Schaumann considers to be an ultra-chronic form of tuberculosis, although there is no positive evidence that this is so.

There is associated with the benign lymphogranuloma enlargement of the hilar glands, a nodular and reticular lymphangitis, a monocytosis and frequently a negative Mantoux; also cutaneous manifestations, viz, lupus pernio and Boeck's sarcoid. This provides a picture very similar to those cases of Burnard and Saye and Hoyle and Vaizey which they describe as lymphogenous.

The lungs are invariably involved in chronic miliary tuberculosis; in point of fact a stippled lung X-ray is essential for diagnosis. As was remarked in a leading article of the British Medical Journal(11) it would be surprising were this not so. Experimentally no matter how an infection is introduced, a lesion will always appear in the lungs. Bartel(26) believes that this is due to the defective lymphatic system of the lungs and quotes the rarity of active tuberculosis in association with any hypertrophy of the lymphatic system. Fishberg(27) pointed out that the lungs were not adequately supplied with arterial blood and that an oligæmia of an organ predisposed it to tuberculous infection; also where there is a

pulmonary hyperaemia as in mitral stenosis, tuberculosis is unusual. In culturing tubercle bacilli, it was found that, in using lung tissue as a medium, they retained their virulence whereas they lost in virulence on using other organs as media. (Porter.28). This was presumed to its lack of oxidising ferments. That the lungs are the first organ for the blood from the right heart to come into contact, is the most important factor in determining pulmonary localisation. Since the venous blood of the right heart receives the lymph drainage from the whole body, it matters not whether the primary focus is related to the hilar or mesenteric glands.

Saye (29) uses the term Chronic Miliary Tuberculosis in a much wider sense than described above. He suggests the following classification.

1. Chronic miliary tuberculosis of primary infection.

2. Chronic miliary tuberculosis of reinfection.

The former appears to be almost synonymous with tuberculous bronchopneumonia and the latter he subdivides into four forms; (a) chronic generalised tuberculosis where an extrapulmonary lesion ends fatally with a miliary spread involving the lungs; (b) localised chronic haematogenous tuberculosis or fibro-caseous disease with generalisation only at the end; (c) 'granulie froide' and (d) non-apparent forms. Such a classification is used to embrace all forms of haematogenous tuberculosis and it is with the latter two only that this thesis is concerned. To use the term chronic miliary tuberculosis in such

a wide sense is to add further confusion to the existing difficulties of nomenclature. The term 'granulie' appears to be a true synonym of acute miliary tuberculosis - hence 'granulie froide' corresponds with the chronic miliary tuberculosis as defined in this thesis. The non-apparent forms may also be included; Saye(38) includes in this group those cases which run an unobtrusive and silent clinical course and may only be diagnosed by an X-ray. He is following up such cases in an attempt to discover whether they have any significance in the development of phthisis, or whether they are recent remains of primary infection.

Vaizey(30) defines the disease in its narrower sense and classifies it on the duration of the fatal issue as follows;

- I. Where the course ends fatally in three to six months; it has an abrupt onset, with pyrexia, dry cough, cyanosis and progresses without remissions. It differs from the acute variety only in that it runs a longer course.
2. Those who died after a course of more than six months with an insidious onset, accompanied by general malaise and slight pyrexia. It has remissions of short duration; in which many of the cases are first called miliary after an extra-pulmonary lesion has necessitated a routine X-ray of the chest. The cause of death varied and may be from fresh infections, toxæmia, from renal or cerebral tuberculosis and occasionally from right heart failure.
3. Those who survived and had two years complete freedom.

Differential Diagnosis

The diagnosis of chronic miliary tuberculosis is based mainly upon the appearance of characteristic stippling of the lung fields seen by radiological examination. But this is not sufficient since there are other conditions which give rise to a very similar skiagram.

The X-ray appearance is that of a lung field showing small discrete opacities fairly evenly distributed and about the size of a millet seed. It is necessary to show that these opacities are due to infection by the tubercle bacillus and that they were disseminated by the blood stream. Since the sputum is frequently negative, collateral evidence must be secured to determine the diagnosis. The presence of fine nodules demonstrable in the liver and spleen, appearing calcified by X-ray, is a valuable support to the diagnosis. A positive skin test is of slight value. But the presence of extrapulmonary lesions of proved tuberculous origin would make the diagnosis certain provided the following other conditions were excluded.

Pneumoconiosis - when exposure to harmful dust can be excluded, this need not be considered.

Tuberculous Bronchopneumonia - occasionally there may be the greatest difficulty in differentiating this condition from miliary tuberculosis. The shadows tend to be more confluent and serial X-rays, especially in the early stages, usually establish

the diagnosis.

Carcinomatosis - the opacities vary more in size and are larger with a tendency to gather towards the bases of the lungs. It appears usually after fifty years of age and the primary growth or neoplastic glands must be demonstrated. Death is fairly rapid and is associated with great dyspnoea.

Pulmonary Congestion - especially congestion of cardiac failure but also with mitral stenosis. The opacities are similar but preponderate around the hila and the bases. The condition of the heart is usually evident.

Broncho-pneumonia - bigger nodules and associated with a reticular shadow. The distribution is more patchy.

Other conditions may simulate the appearances and have to be taken into consideration when there is doubt and when the above have been excluded.

Bronchiolitis fibrosa may be indistinguishable in the absence of bacteriological evidence. Less frequently disseminated blood following a haemoptysis, periarteritis nodosa, Boeck's sarcoid, syphilis, xanthomatosis, bilharziasis and miliary amyloidosis are a source of difficulty.

According to Landau(37) benign lymphogranuloma may be identical with the disseminated lymphatic pulmonary tuberculosis which can be differentiated by its characteristic reticular shadow.

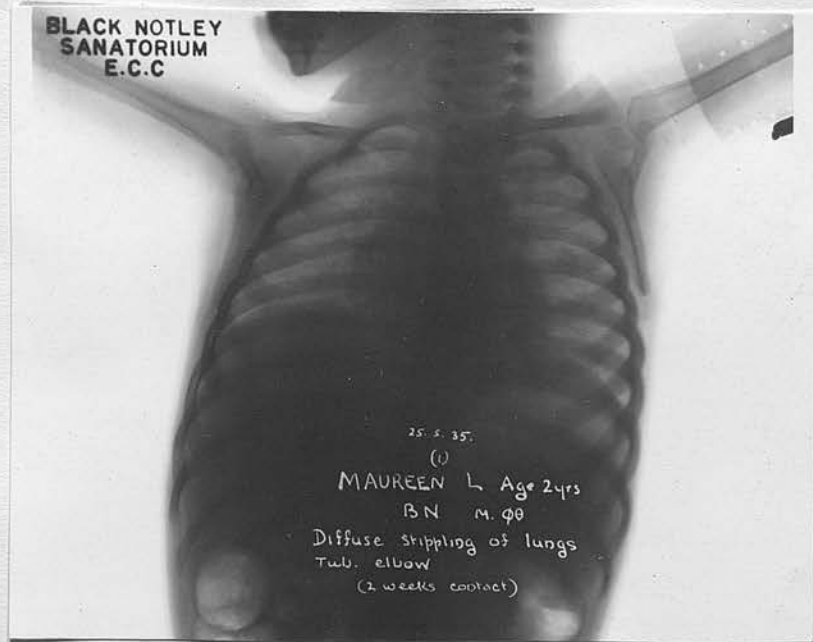
It is possible to differentiate the acute from the chronic variety by an analysis of the clinical and radiological findings. Burton Wood(10) tabulated

Acute Miliary

1. An acute illness terminating in death in two to six weeks.
2. Progressive and rapid wasting.
3. Physical signs may be absent but scattered fine crepitations may be heard.
4. Cyanosis usually present and may be marked.
5. Acute pyrexia.
6. May be associated with meningitis.
7. Snow storm appearance in lungs by X-ray.
8. Skin reaction may be negative.

Chronic Miliary

1. A chronic malaise followed by resolution or by slow development of chronic phthisis.
2. May be plump or poorly nourished.
3. Physical signs absent or those of chronic catarrh.
4. No cyanosis.
5. Normal or subfebrile.
6. Associated with enlargement of hilum glands and exudative phenomena.
7. Coarser stippling and less universal distribution in the lung fields.
8. Usually strongly positive skin reaction.



Case 1. Shortly after admission.

It is proposed to present a record of ten cases seen at the above sanatorium. They are all of proved tuberculous origin, and exhibit X-ray appearances of stippling compatible with the diagnosis of Chronic Miliary Tuberculosis as defined above. There has been no selection made and they represent all the cases of this type admitted since 1932.

Casel. Chronic Miliary Tuberculosis with Calcification of primary focus.

A female child, M.L. aged 16 months was admitted in April, 1935. She was the child of a tuberculous mother with whom she had been in contact for only fourteen days. She had been fed on Nestle's milk, making poor progress at first but improving later.

Two months before admission she developed scarlet fever and was sent to an isolation hospital; during her stay there, she developed pain and swelling of the left elbow.

After transfer to the sanatorium, she was found to have a fluctuating swelling on the inner side of the left elbow which was flexed at a right angle. X-ray showed erosion of the joint surfaces, accompanied by abscess formation.

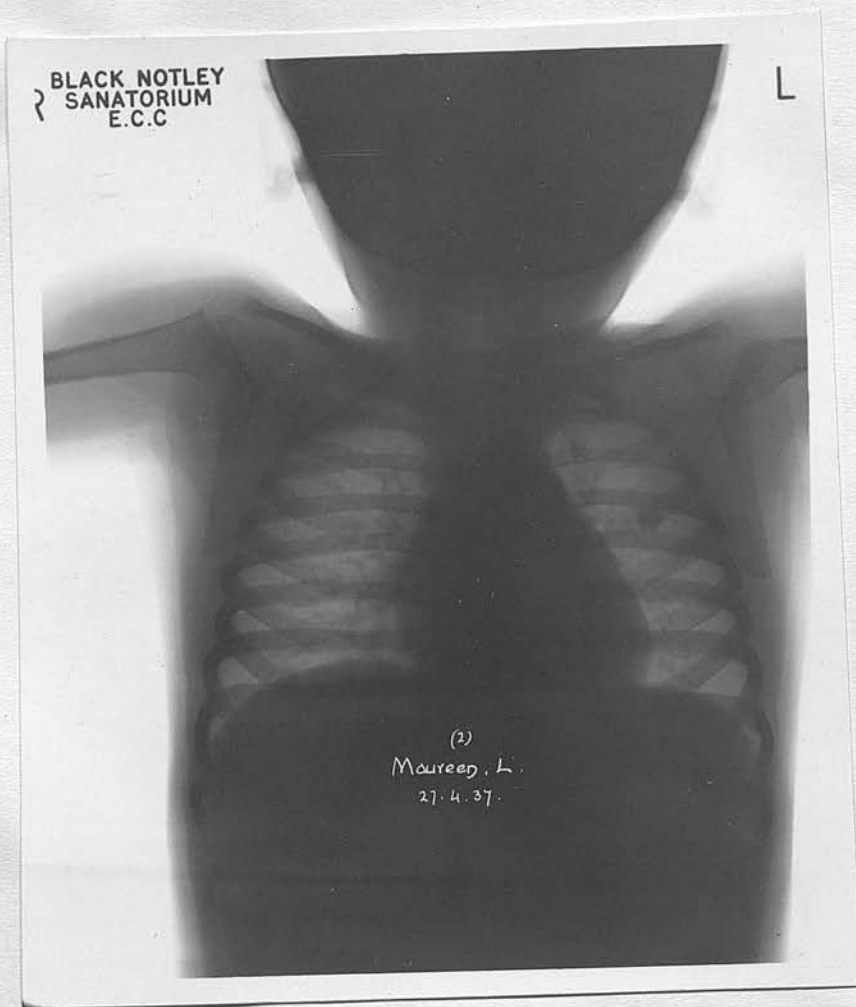
The child appeared to be in fairly good condition, having no symptoms or clinical signs of disease elsewhere. A skiagram of the chest however, showed a diffuse stippling of both lung fields.

Course - the abscess was evacuated and the joint curetted. The pus contained tubercle bacilli. The wound healed leaving a small ulcer and sinus which was again curetted before it finally healed.

Nine months after admission the X-ray of the lungs showed considerable reduction of the stippling and calcification commencing at the left apex. Three months later a mass of calcifying glands were becoming apparent at the left root with the stippling still less obvious. At this stage a phlyctenular conjunctivitis appeared and rapidly cleared up.

At no time were tubercle bacilli found in the sputum or faeces.

She developed a scarlatinal rash and had to be sent to the isolation hospital. After this cleared up, she was readmitted on account of the previous findings in the lung X-ray. She remained three months and on discharge, the lung fields were quite clear apart from some calcified nodes in the left lung.

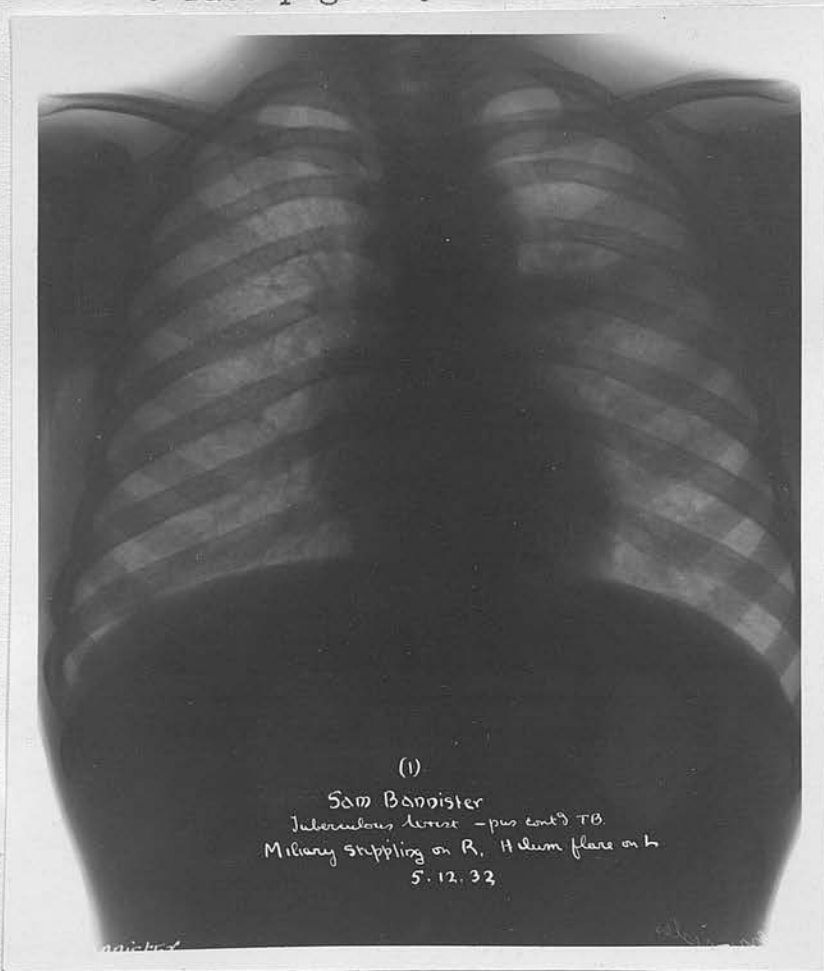


Case 1. Two years after showing
absence of stippling and calc-
ification of primary focus.

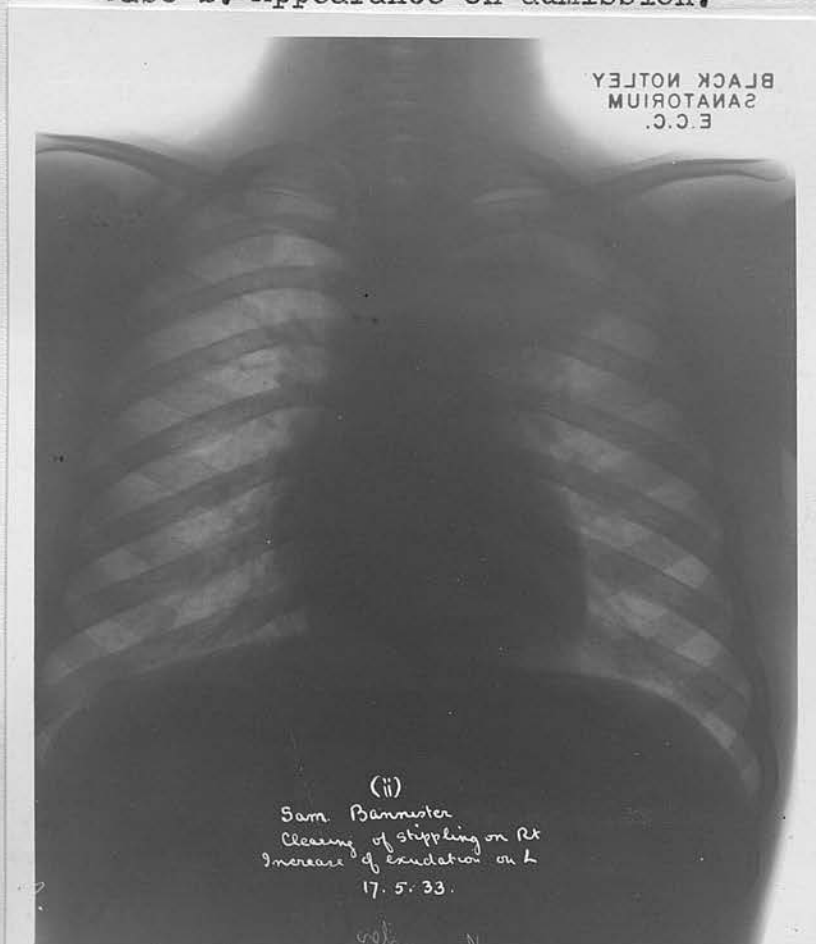
This child developed a tuberculous lesion of the elbow joint following upon an attack of scarlet fever. A miliary stippling of the lungs is found in the course of a routine examination. Pus forms and is evacuated; the general condition improves and the miliary stippling disappears with calcification of the primary nodules and associated mediastinal glands.

The arrival, progress and retrogression of the infection can be followed step by step from the history and skiagrams. A severe primary infection by contact with the mother - immunity developing but interfered with by contracting scarlet fever - haematogenous spread to elbow and lungs - immunity recovering with pus formation, fibrosis and calcification.

Surely this is a very instructive case. A recently developed immunity, weakened by intercurrent disease reasserts itself to produce recovery. From the X-ray findings it would be permitted to assert that this child had been dangerously ill; yet at no time did she present any symptoms of any chest trouble and the only pyrexial period was during the week following the curetting of the elbow. This is clearly a case of haematogenous spread affecting the lungs via the thoracic duct; the widening of the upper mediastinal shadow, representing enlarged paratracheal glands, may be seen in the skiagram. The systemic spread was most probably through the ulceration of an initial tubercle in the pulmonary veins by direct



Case 2. Appearance on admission.



spread from one of the primary nodules.

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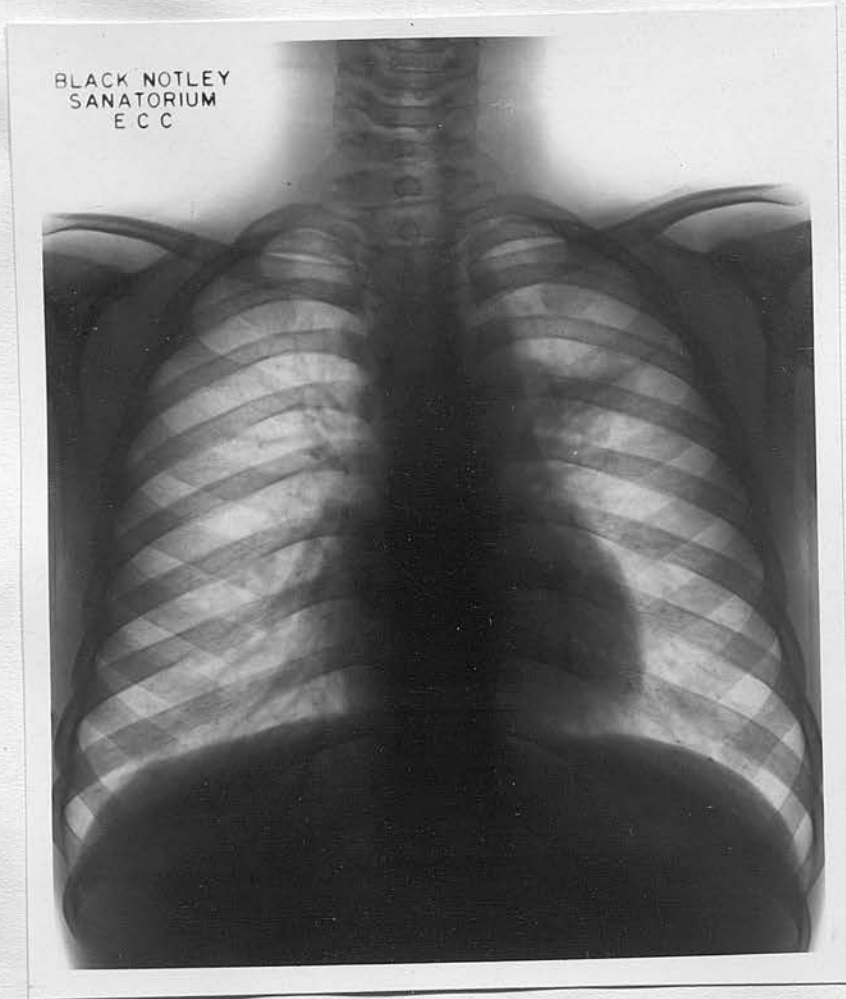
The only treatment which this case received was absolute rest combined with adequate treatment for the prominent lesion. There was no sign of unexpected flare of the lesion in the lungs even after a surgical operation. Three years after the disease first became manifest, she is well.

Case 2. Chronic Miliary Tuberculosis with Hilum Flare.

A male school child, S.M.B. aged 12, was admitted to the sanatorium, suffering from a painful right wrist of two to three months duration. His sister had a tubercular enteritis and his stepmother had pulmonary tuberculosis; he had been in contact with both. He was a fairly well nourished child on admission with no history of past illness. The X-ray of the wrist had appearances suggestive of tuberculosis with abscess formation. There was a slight cough but no physical signs nor sputum. The X-ray of the chest showed a miliary stippling on the right side with an exudative flare radiating from the hilum of the left side.

Course - the wrist condition advanced to frank abscess formation; the pus was repeatedly aspirated and was found to contain tubercle bacilli. At the end of six months the stippling was diminishing but the exudation was increasing on the left side; during the following four months the stippling had completely disappeared and the exudation of the left side was considerably less. Eighteen months after admission the child was discharged with the wrist condition completely quiescent and both lung fields clear radiologically and clinically.

A further twenty months later the child was re-admitted complaining of pain and difficulty in walking with the left hip, associated with wasting and shortening of the limb. The X-ray showed signs of bone destruction. Ten months later a symptomless haematuria developed and the urine contained, pus, blood and tubercle bacilli. A guinea pig enoculation from both ureters was positive to tuberculosis. Serial X-rays of the chest showed no further sign of stippling or exudation during his second stay. The wrist condition also remained quiescent. He was discharged with the hip condition satisfactorily healed and the kidney and bladder showing no signs of increased activity. He has remained well during the past eighteen months.



Case 2. Appearance on discharge.

The stippling seen in the chest X-ray has a softer appearance than usual in this case; there is also a flare seen radiating from the enlarged hilum glands. The miliary stippling disappeared even before the exudative flare. Surely this case goes far to support Burton Wood's suggestion that, in some instances, the miliary appearance might be an epituberculous manifestation.

Here again there is ample evidence of the haematogenous spread of the infection. Lesions as remote as the wrist, the hip, the genito-urinary system and the lungs are present. Intermittent reinfection of the blood stream over a known period of four years is apparent from the history.

There is also the presence of pus associated with apparent recovery.

It is suggested that the prognosis in this case is not very good, for the following reasons;

The softer stippling and the exudation suggest a more highly allergic subject. According to Rich (16) the tissue reaction is more severe, with necrosis and greater tendency to ulceration, in allergic persons. Therefore if the stippling is due to haematogenous implantation, a further reinfection might be fatal. Also the presence of genito-urinary tuberculosis, even in the absence of recognisable damage, is a bad prognostic omen.

R.B. a shop assistant, aged sixteen, was admitted to the sanatorium in March of this year. There was no history of close contact with tuberculosis, but her aunt had pulmonary tuberculosis, as well as her cousin who died from it.

The patient's previous health was excellent until three months prior to admission, when she had a slight haemoptysis. About a month later she developed a slight cough with pain in the left side of the chest. There was some sputum which contained tubercle bacilli. There had been a slight loss of weight.

At the time of admission, she appeared in good condition, with no clubbing, and weighing 8st. 3lbs. There was no pyrexia and a slight tachycardia was present. Fine dry crepitations with weak breath sounds could be heard all over the chest. She had a mitral stenosis with no regurgitation. The blood sedimentation rate was 15.

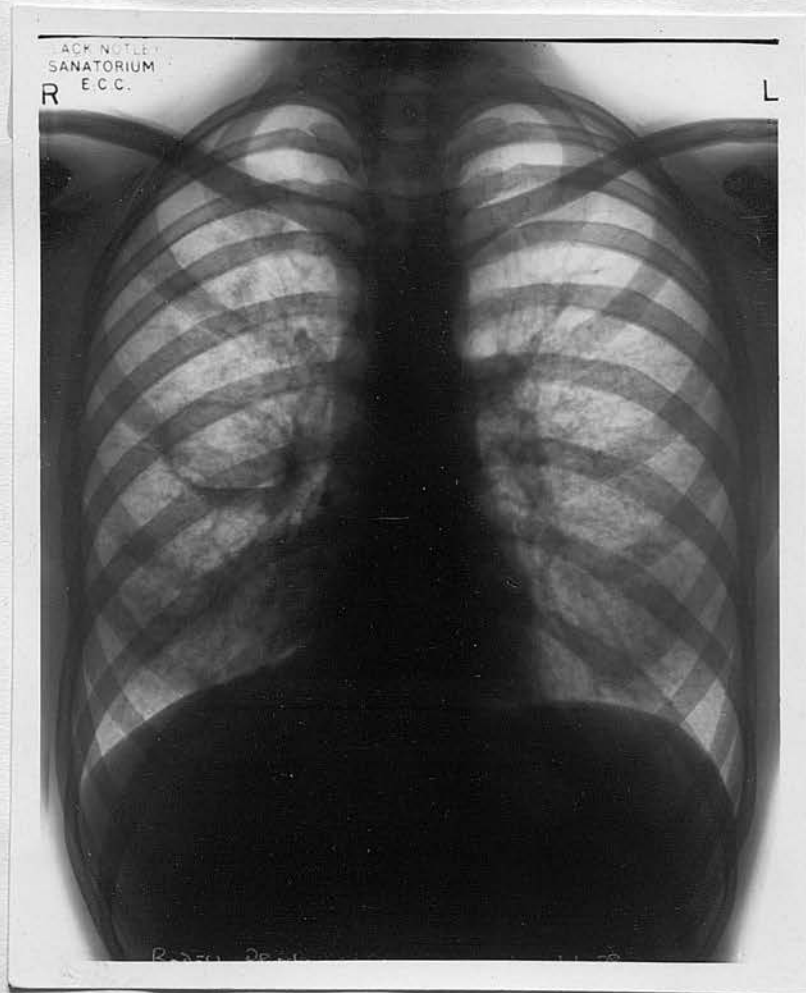
The X-ray of the chest showed a disseminated granular stippling of the lower and middle zones of both lungs extending up to the infraclavicular zones; a large cavity was present near the right hilum.

Course - the patient was put, at first, on six weeks absolute rest. At the end of this time, she was still apyrexial, she had increased eight pounds in weight, no crepitations could be heard and no cough was present. The X-ray showed some diminution in the mottling and the cavity was appreciably smaller. A further six weeks absolute rest was given during which time she had a course of intravenous Sanocrysin. Physical signs were still absent and no pyrexia manifested itself. Radiologically the stippling was further diminished and the cavity had almost disappeared.

Commentary on case 3.

Although this case is still having treatment, it has been included in the series on account of several unusual features. Firstly there would have been some doubt as to the correctness of the diagnosis, had it not been confirmed by an eminent phthisiologist.

The apices are almost free of mottling, which preponderates at the bases and around the hila; the converse distribution is more usual in chronic miliary tuberculosis. Furthermore the patient has a mitral stenosis, with no sign of failure; this heart



Case 3. Appearance on admission.

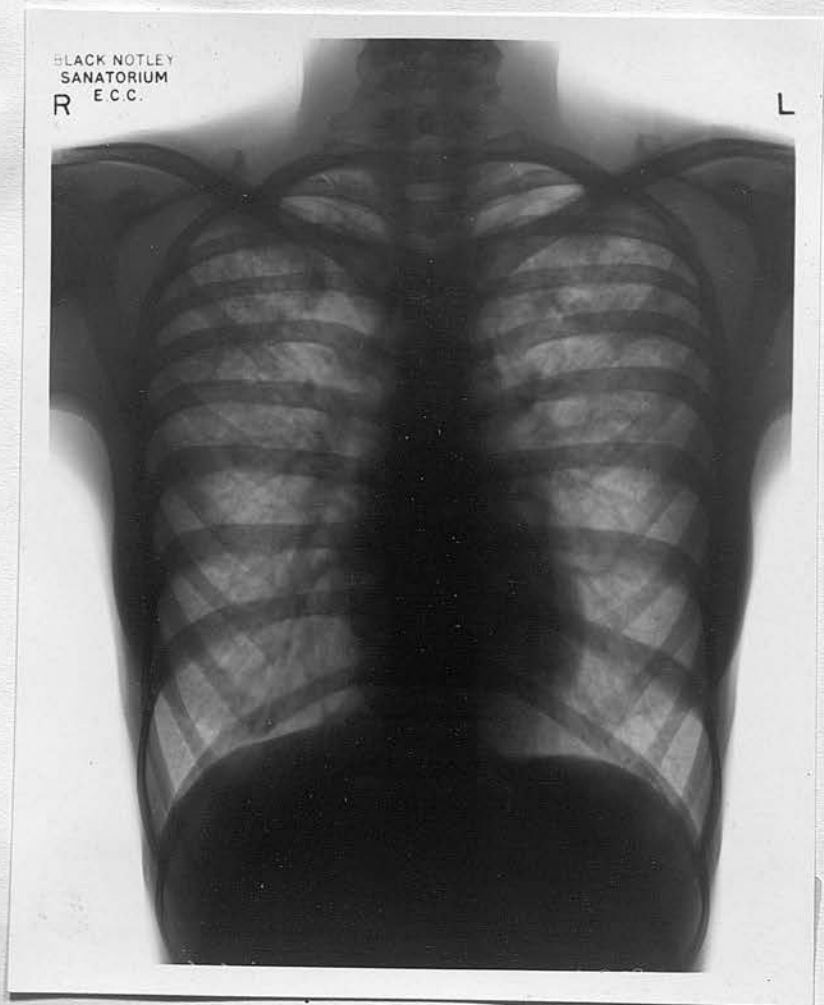
may produce a picture identical with that found in this case, according to Zdansky (39). But here there is cavitation and sputum containing tubercle bacilli. Also the mottling is not disappearing as rapidly as might be expected in the case of a congestive condition having strict absolute rest. Again there is no gross enlargement of the right heart seen radiologically.

It would appear that the presence of a mitral lesion has had some influence on the distribution of the infection. Fishberg (27) pointed out that tuberculosis was unusual in cases of mitral stenosis. There may be an improved apical circulation with an increasing tendency to stagnation towards the bases, to account for the unusual distribution in this instance, and permitting an easier implantation of a virulent infection.

Case 4. Chronic Miliary Tuberculosis with signs and symptoms corresponding to the 'granulie froide' of Saye.

A female, D.H. aged 18, was admitted with a history of feeling run down for the past three months. There was no family history of tuberculosis nor were there any known contacts. She had been previously well, having had measles in childhood. On admission she was a thin girl with a toxic appearance; there had been some loss of weight, but no pyrexia. She developed a dry cough soon after. Clinical signs in the chest were absent but the X-ray showed a fine stippling of the upper and middle zones of both lungs of almost identical distribution. There was no sputum but the mirror test provided tubercle bacilli. The blood sedimentation rate was 58. The blood count was as follows; R.B.C. - 4,750,000 and Hb. - 82%.

Course - a week after admission, her temperature rose



Case 4. Appearance on admission.

to a maximum of 100. During the following two months it continued to swing daily when it finally settled to normal and remained so. After this her general condition steadily improved. She had been having 'strict absolute rest'. She appeared to be definitely less toxic, had put on weight, the B.S.R. had dropped to 28 and her cough had disappeared at the end of four months. The skiagram of the chest showed some diminution in the stippling.

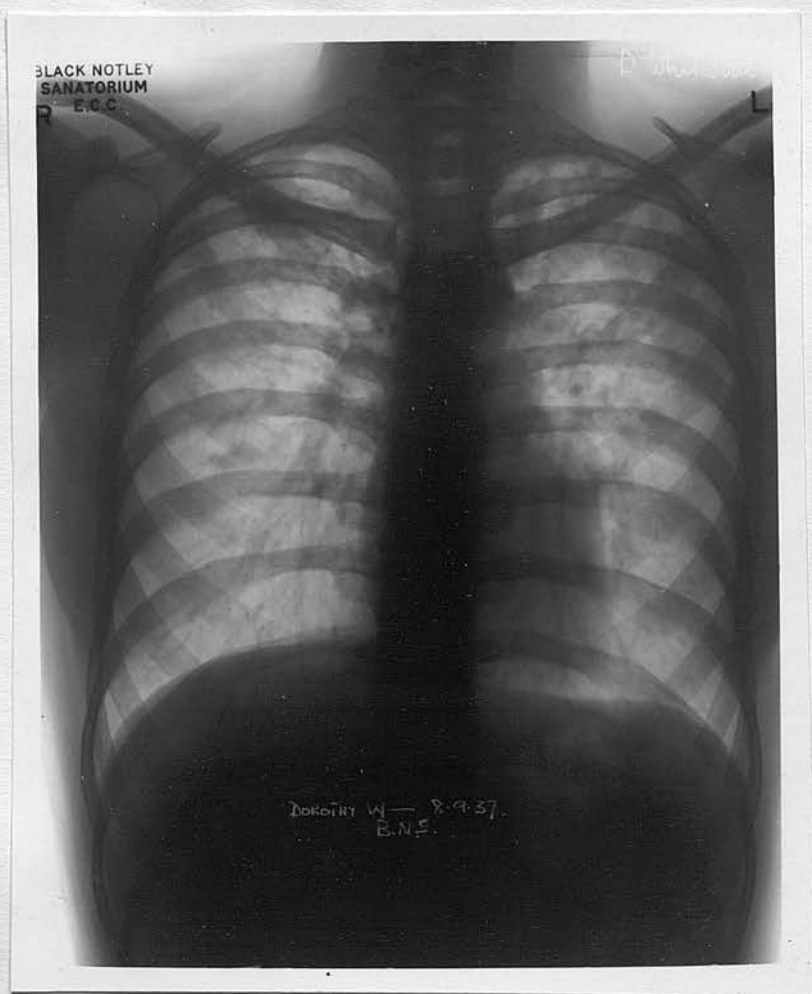
Commentary on Case 4.

Here the findings correspond very closely to those of 'granulie froide' as described by Saye. The stippling here is distributed in the zones which were free in the previous case.

The resistance of this individual was obviously poor as evidenced by her thin, toxic appearance, and her high B.S.R.

An interesting feature was the remarkable symmetry of the stippling at the apices and the freedom of the middle and lower zones. It could not be accounted for by a lymphatic spread. A possible explanation is that a haematogenous dissemination involved the whole of both lungs, but was overcome except at the apices which are notoriously vulnerable. It might be suggested that, had she been more robust, the infection would have been completely aborted.

To face page 25.



Case 5. Showed same granular appearance throughout her stay.

Case 5. Chronic Miliary Tuberculosis associated with pregnancy.

D.W. a housewife, aged 27, was admitted with the following history. Eight years ago she had been treated for pulmonary tuberculosis in a sanatorium in which she was detained for nine months. There had been a slight haemoptysis at first which drew attention to the lungs. Shortly after discharge she developed a left sided pleurisy from which she made an uneventful recovery. As far as could be ascertained, the sputum had been negative throughout. Four years later she had a therapeutic abortion, and shortly after she began to complain of pains in the lower part of her back. These pains disappeared in the course of a short time.

She became pregnant again and produced a live child seven months prior to admission. Following the birth the pains in her back returned.

On admission, there was a well marked upper lumbar hump and the back was quite rigid. X-ray showed caries and collapse of the 2nd and 3rd lumbar vertebrae with some evidence of sclerosis; a right psoas abscess was visible but there was no paralysis. Examination of the chest showed slight diminution of breath sounds at the right apex. There was no cough and no sputum. The X-ray report was multiple round discrete foci scattered throughout both lungs.

Course - the spinal condition progressed satisfactorily and she was discharged with a brace one year after admission. Throughout her stay the chest condition had remained the same. Serial skiagrams showed no change in the lung appearance. At no time had it been possible to obtain sputum and the mirror test was repeatedly negative.

Commentary on Case 5.

In this instance there is a history of a previous lung lesion associated later with an effusion. This apparently quite cleared up. Pregnancy intervened and there was a further reinfection, when the resistance was lowered.

The skiagram differs from the previous cases in that the stippling is larger, fluffier and less evenly distributed. Its character did not change during the year she was under observation. The widening of the upper mediastinal shadow is also noticable.



Case. 6. Showing normal lung shadows with thickening at left base.

Until 1927, J.B. aged 51, had enjoyed good health. At that time he had a right orchidectomy for a proved tubercular testis - the kidneys showing no sign of being similarly affected.

There was no family history of tuberculosis nor were there any known contacts.

He was admitted to the sanatorium in 1932, having for the past five months, suffered with increasing pain in the upper part of his back without, however, any accompanying loss of weight or apparent ill health. His general condition was good but there was a generalised mid-dorsal hump which the X-ray showed to be due to caries of the 6th and 7th dorsal vertebrae associated with abscess formation.

The chest skiagram showed normal lung shadows with slight pleural thickening at the left base.

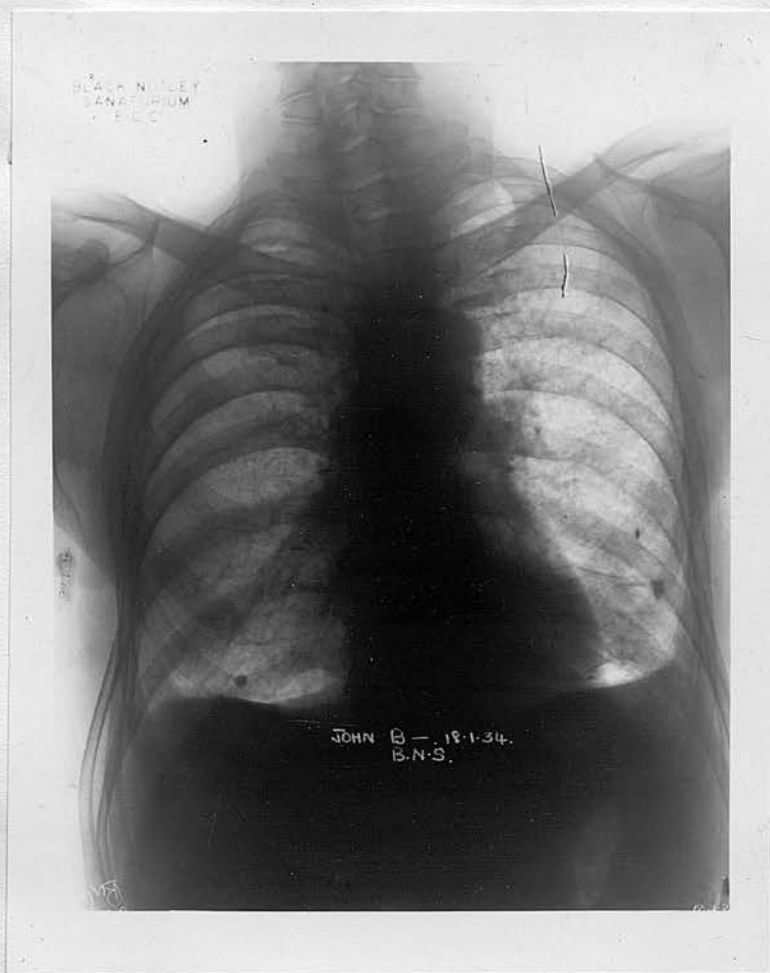
Course - there was satisfactory progress for five months when he began to have persistent pain in the region of the right scapula; dullness was present over both lungs and no breath sounds could be heard. The radiological findings were those of a bilateral pleurisy which completely cleared up in the course of three months leaving thickened pleura at both bases; guinea pig enoculation with the pleural fluid was positive to tuberculosis at the third attempt. At this stage, the left testicle flared up and there was also some swelling of the left knee and foot. The X-ray of the knee showed no evidence of disease and it was recommended that the testicle be removed when the general condition improved.

Meanwhile the spinal caries was spreading; pus was aspirated and contained tubercle bacilli. The cerebro-spinal fluid contained no abnormal constituents.

Up to this time, that is twelve months after admission, the lungs had provided no evidence of active disease apart from the pleurisy. Then the voice became slightly husky; the vocal cords were normal but the skiagram showed some mottling at the right apex. Sputum contained no tubercle bacilli.

Two months later he suddenly became breathless and somewhat cyanosed; there was diminished breath sound and percussion note over both lungs. The x-ray showed very diffuse miliary mottling throughout both lung fields; The sputum was still negative and the B.S.R. was 44. During the following three weeks, there was a slight improvement generally and in the dyspnoea and cyanosis, the chest signs remaining those of an old standing pleurisy.

When the relatives were warned that this man was going to die, they insisted on his returning home. Seven months later the authorities were surprised at a request from the patient for the spinal support for which he had been measured prior to his relapse. The reason was that he might be able to get about



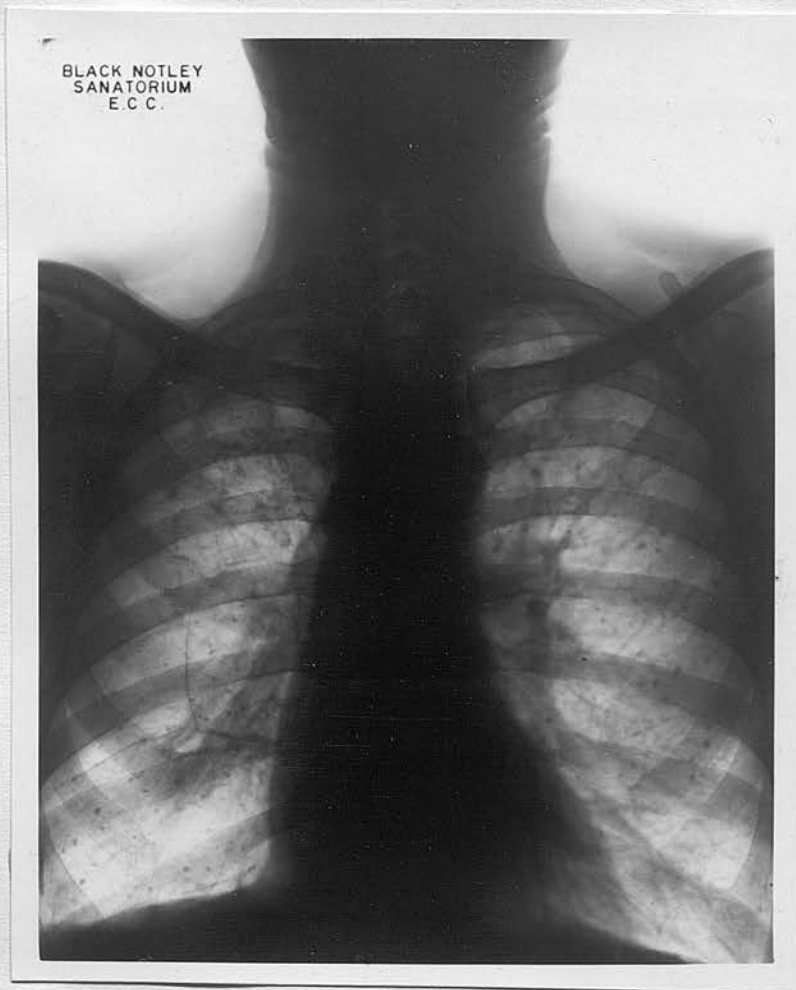
Case. 6. Showing diffuse military stippling over both lung fields.

better with its assistance. It was later discovered that the man had died at his home thirteen months after leaving the sanatorium. The cause of death was unknown but presumably was tuberculosis.

Commentary on Case 6.

This is the only case in the series in which the miliary condition developed while the patient was under observation. Also in no other case did the symptoms draw attention to the chest involvement. It may also be seen that recurrent reinfections of the blood took place at intervals. The right and left testes, the vertebrae, the left knee, the pleura and the lungs were all affected in turn. With the arrival of each lesion, there was an accompanying rise in temperature; that the cause of this was a tuberculous bacillaemia is highly probable. It is perhaps permissible to suggest that the bilateral pleurisy was a reaction to an abortive attack of miliary tuberculosis of the lungs. The marked widening of the upper mediastinal shadow is seen also in this case. The presence of pus is also to be noted. The skiagram of the chest when the patient was dyspnoeic and cyanosed showed that the reinfection must have been massive to an extreme degree; the resistance to withstand it must have been considerable. His case was considered to be hopeless, yet he returned home and survived for more than a year without any special treatment and was ambulatory seven months after he was discharged. It seems probable that, had he remained under observation and had strict rest, he might have been alive today. It is extremely unfort-

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Case. 7. Showing calcified miliary tubercles.

unfortunate that his case could not have been followed up and the ultimate cause of death discovered.

28.

Case 7. Chronic Military Tuberculosis with calcification of the military tubercles.

R. Mc. a male, aged 53, was admitted in September, 1934. He had been diagnosed as pulmonary tuberculosis in 1919 for which he had treatment for two years; he then returned to work and remained well for five years when his left knee and testicle became troublesome; the testicle was removed and he was discharged from hospital with a knee splint which he was advised to wear constantly. From 1928 to 1934 he remained at work. At this time he discarded his splint, on advice. The knee became more and more painful and sanatorium treatment was recommended.

On admission the general condition was good; there was some clubbing of the fingers; the vision of the right eye was nil and there was evidence of a trephining and a previous irido-cyclitis. The left knee had some thickening, chiefly on the inner aspect of the joint line accompanied by tenderness and slight spasm.

The chest examination suggested cavitation in the right interscapular region; the X-ray showed very discrete military shadows throughout both lungs with a small cavity at the right apex. There was no cough but the sputum contained tubercle bacilli.

A lumbar hump was found which had given rise to no symptoms; the X-ray showed caries of the 1st and 2nd lumbar vertebrae which appeared to be quiescent. The urine, blood and faeces were negative to tubercle bacilli and the B.S.R. was 20.

Course - the patient's condition remained the same for two months when he began to suffer with pain in the right chest on inspiration and accompanied by slight fever. Coarse friction sounds were present at the right base; the skiagram showed no apparent change in the lungs. At the same time the knee gave signs of fluctuation; the pus was repeatedly aspirated and contained tubercle bacilli. No evidence of activity in the spinal lesion was found.

The chest condition settled down; the knee joint was excised six months later and much diseased bone was removed. From then until his discharge two years after admission, he made satisfactory progress. His sputum contained tubercle bacilli throughout and serial X-rays of his chest showed that the lung condition had remained the same during his stay in the sanatorium. His B.S.R. was 7 on discharge. He has remained well since.

Commentary on Case 7.

See next page.

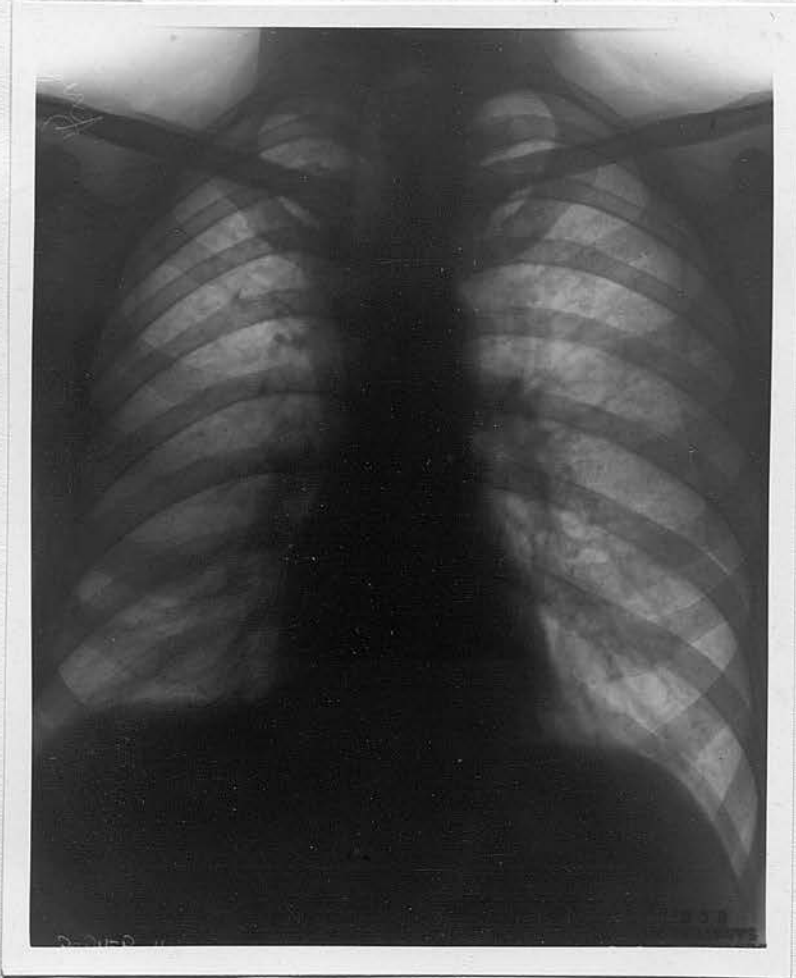
This man's known tuberculous history extends over a period of twenty years, during which time he has successfully overcome lesions in the lungs, spine, knee, testes, and probably eyes(irido-cyclitis). It is probable that the miliary stippling of the lungs is of very old standing since appearances by X-ray suggest dense fibrosis and even calcification of the miliary nodules. What had been called pulmonary tuberculosis twenty years ago, might have given rise to the present appearances.

During the pyrexial period when the knee began to show signs of fluctuation and the pleural inflammation appeared, the small cavity presented no signs of increased activity nor was there any apparent tendency for the miliary tubercles to break down.

Here is an individual whose defensive mechanism has successfully combated recurrent invasions of the tubercle bacillus. His general well being was, at no time, greatly undermined by the disease in spite of the fact that the invasion which involved his lungs must have been massive; the power of his resistance is manifest in the tendency to dense fibrosis in the lungs and in the previously unsuspected lesion in the spine.

Again the distribution of the miliary stippling and the remoteness of the other lesions can leave no doubt that the dissemination of the infection was by the blood stream.

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Case. 8. Showing fine bilateral military stippling.

Case 8. Chronic Miliary Tuberculosis

This man, F.P. aged 47, commenced his tuberculous history in 1932. He had a good family history and had not been in contact with any known tuberculous persons. At that time he developed a right pleural effusion and appearances suggestive of rt. apical disease, associated with night sweats and feeling of lassitude. There was no sputum and no tubercle bacilli could be found. A month later swelling of the left testicle appeared; an orchidectomy was performed and healed by first intention. He remained well for two years when the right testis showed signs of inflammation; he was given a suspensory bandage and it settled down. At this time he began to suffer from some 'weakness of the right eye'. He attended a dispensary every six months; his chest had given no indication of activity and the testis did not give further trouble until Dec. 1937.

When he was admitted to the sanatorium he was in good general condition but had been losing weight. The right epididymus was scraggy and tender as was the lower end of the cord. There was no cough or sputum and there was a diminished percussion note on the right side. The X-ray of the chest showed a fine bilateral miliary stippling in the lung fields.

Course - the urine was repeatedly examined and was negative to tuberculosis. Descending pyelograms gave no evidence of kidney disease. There was no pyrexia. The swelling of the scrotum increased and pus was aspirated. The prostate and both seminal vesicles showed signs of invasion. The B.S.R. was 2.

The condition of the chest remained the same.

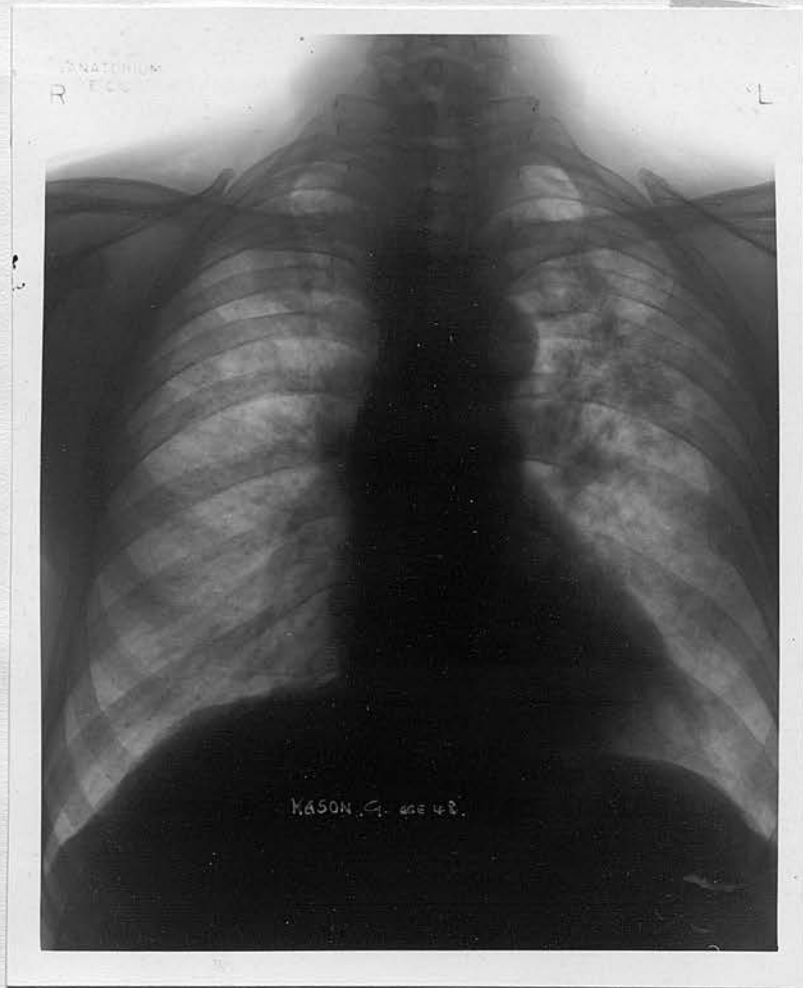
A right epididymectomy and partial orchidectomy was performed under evipan anaesthesia. The wound did not heal by first intention as there was sloughing of the testicle, which cleared up later.

The patient is now very much improved, has put on weight and shows no signs of any further spread of the infection. At no time during his stay has the chest showed any evidence of activity, nor is there any change in the radiological picture of the lungs.

Case 9. Chronic Miliary Tuberculosis

A male patient, G.W.M. aged 39, was admitted with a history of persistent backache for a considerable period. Prior to this, his general health had been excellent. He was a boot-maker by trade and had made no close contact with tuberculosis. He was admitted to a general hospital where he was provided with a brace and a diagnosis of spinal caries. After this the general condition deteriorated, the pain in the back got worse, and a cough in association with pain

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Case. 9. Appearance on admission.

in the chest developed.

On admission, he was in a poor condition, with a slight deformity of the back, moderate mobility, and no tenderness or evidence of paralysis. The skiagram of the spine showed caries of the 7th, 8th, and 9th dorsal vertebrae with abscess formation. There were no clinical signs in the chest and the sputum was negative. X-ray showed a coarse mottling over both lung fields.

Course - the patient made satisfactory progress for three months when his temperature began to swing up to 101 where it had previously remained within normal limits. The cough became worse, there was impaired percussion over the left base with crepitations and a friction rub. The X-ray showed little change from admission. Within fourteen days the pyrexia settled and the chest condition became more normal. An x-ray of the spine taken a fortnight later gave appearances suggestive of further activity with a large abscess obscuring the 6th to the 12th dorsal vertebrae.

During the following three months the general condition improved and the spinal caries remained quiescent. Serial X-rays of the lungs, however, suggested a tendency to increase in the stippling and greater density in the shadows at the upper mediastinal angle.

He was later allowed to walk about with the aid of a spinal brace and was ultimately sent to a convalescent home, his condition having apparently reached a stationary stage.

Commentary on Cases 8 and 9.

The above two cases are discussed together since they present no features which were not found in the previous cases. The phthisiologist would call them surgical tuberculosis of the lungs. There can be little doubt that a haematogenous infection was present in both instances, particularly so in Case 9 where the renewed activity of the spine was preceded only by a short period, by a flare up in the lungs. Also a visible widening of the upper mediastinal angle could be seen during his stay in the sanatorium. One might go so far as to suggest that a further reinfection is likely in the near future,

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Case. 9. Six months later. Note tendency to confluence of miliary shadows with widening of the upper mediastinal shadow.

from the appearances of the last lung X-ray.

In case 8 the involvement of the right testicle was probably via the genital lymphatics from the left side. But here again, prior to the left testicular involvement there is a history of preliminary lung trouble in the form of a pleurisy and apical disease. One might be justified in saying that the prognosis in this case was better, since no change was seen in the pulmonary stippling or hilum shadows, during his stay.

Case 10. Chronic Miliary Tuberculosis.

C.C. a well built, sunburnt male, aged 38, was admitted with a history of having had lumbago for the past two years. Five years previously he had tuberculosis of the radius of the left side associated with abscess formation. The abscess had been opened and spreading from the scar was a warty lupus condition of the left hand.

Three months prior to admission, he had haematuria and frequency for a day. A spasmodic pain in the back appeared with increasing frequency.

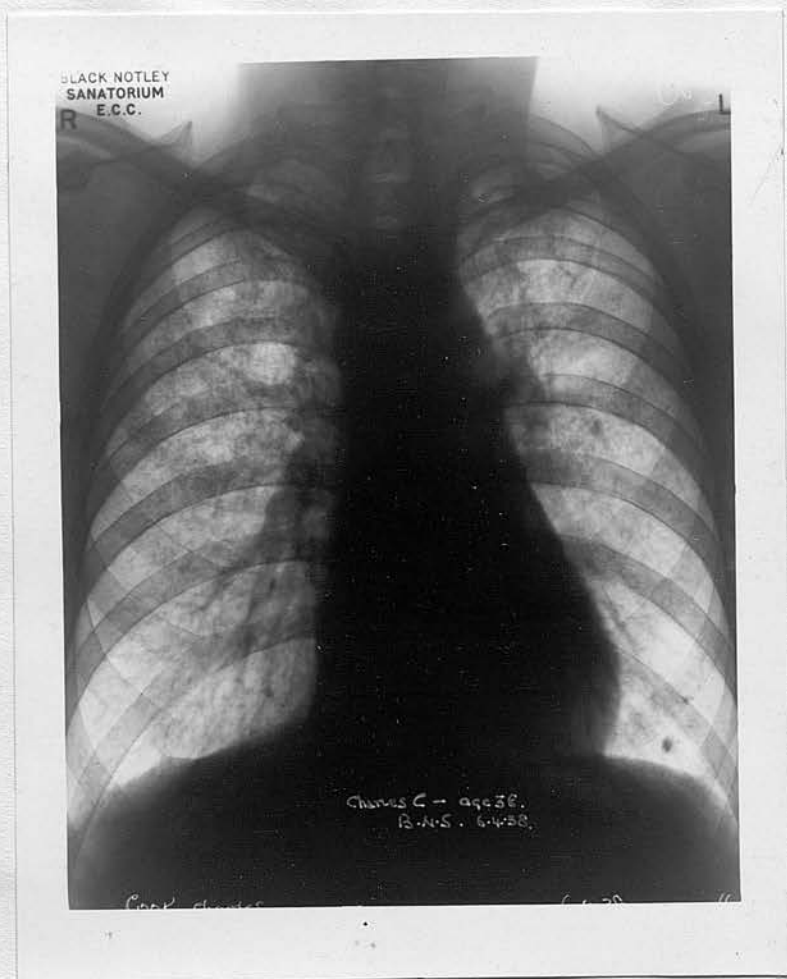
On examination there was some tenderness in the left loin; the urine contained tubercle bacilli; an ascending pyelogram showed damage to the lower pole of the left kidney. The right showed no change.

There was no cough nor sputum; clinical signs were absent from the chest. But the X-ray of the chest showed a diffuse miliary mottling of chronic type. The wrist condition was apparently quiescent.

Course - serial X-rays of the chest showed no change nor was there any apparent change in his general condition which remained excellent. Tubercle bacilli were still present in the urine but there was no evidence to suggest further spread in the genito-urinary tract. To all appearances, the condition is quite stationary and he still remains under observation.

Commentary on Case 10

The findings here suggest an infection of a very chronic type. A history referable to kidney disease dates back at least two years and during this period



Case. 10. Miliary stippling of
Both lung fields. No change seen
in serial X-rays.

a surprisingly small amount of damage has been done; furthermore the patient has felt and looked well throughout. The appearance of the patient and the course of the disease suggest a high individual resistance and it seems probable that the stippling of the lungs arose prior to the involvement of the radius and has remained since. In other words the extrapulmonary dissemination took place five years ago and lay dormant in the left kidney until some lowering of resistance permitted the infection to progress but only very slowly. In this case again there is a history of abscess formation, the possible significance of which is discussed later. In spite of the high resistance, however, the outlook cannot be too optimistic owing to the kidney involvement. It seems likely that the disease will progress slowly throughout the genito-urinary tract by direct spread until such time as his immunity breaks down to allow of a further haematogenous dissemination.

Discussion.

A perusal of the above case records will show that only three features are common to them all. Firstly, a miliary stippling was seen in their chest skiagrams, secondly, the tubercle bacillus was found to be present, and lastly there was a tendency to run a prolonged course. The two former are found in acute miliary tuberculosis and as Fish(24) pointed out, there is no essential difference pathologically between the acute and the chronic forms. Clinically it seems that the course which a miliary tuberculosis takes, is determined by the character of the individual response to the dissemination. Case 6 was termed acute miliary tuberculosis and was labelled 'chronic' only after he was found to have survived for a year. It would be eminently moresatisfactory were it possible to ascertain the ultimate fate of the individual at the outset. It would involve a measurement of the mechanism of humoral defence; various attempts to assess this have been tried but have been found lacking in some essential.

The blood sedimentation rate is one of the newer aids to prognosis. A high rate is taken to be a bad prognostic sign in tuberculosis. The individual variations are considerable but a rise or a fall is of prognostic value. In the two cases in which it was used the fall corresponded with improvement. It is not a measure of allergy, as has been suggested, since Bray(40) found it to be frequently normal in allergic asthma and hay-fever.

The Mantoux Test was positive in all the cases; it approximates to a measure of allergy. A negative result would be of grave significance in an established military case, since it would mean that the dissemination had occurred before any defensive mechanism had developed.

The Houghton Index (41) is of further value in estimating the resistance, especially in pneumothorax. Although its use in military tuberculosis has not been recorded, it might, with profit, be used. An index of over 260 is regarded as within normal limits, while a diminution of the index is of bad prognosis.

There does not, however, appear to be any likelihood that it will ever be possible to give mathematical expression to biological states. At present, a careful and intelligent consideration of all the available clinical and laboratory data is essential.

An interesting feature of six of the above cases was the presence of pus at some time during the process of healing. Also on examining the published cases of others, a high recovery rate was observed where pus was exhibited. The formation of pus may only be a measure of chronicity but it seems possible that, associated with its formation, some antitoxic substance is liberated which has a generalised healing effect. It must be remembered that, tuberculous 'pus' is not, strictly speaking, pus at all. It consists mainly of the debris of dead 'epitheloid' cells with some admixture of barely recognisable pus cells. In the blood the response to

tubercular infection is an increased monocytosis; and the monocyte is almost identical with the epithelioid cell of the tubercle. (Medlar and Kastlin, 42.) A parallel might be drawn with the action of toxoid, used in the active immunisation against diphtheria, which, when injected, is not infrequently followed by abscess formation, even when the most asepsis is observed. If there is such a therapeutic agent present in tuberculous pus, it is probably closely related to tuberculin which has been used in treating military tuberculosis but with no conspicuous success. Further research into the preparation and exhibition of tuberculin and correlating the composition of tuberculous exudates in its manufacture, would be of interest and possibly of importance. Pagel (44) found that in chronic haematogenous tuberculosis, the bactericidal power of the blood serum was considerably increased as compared with that found in ordinary bronchogenic phthisis, A review of the above cases leaves small cause for doubt as to the haematogenous nature of the dissemination. In seven instances a widening of the upper mediastinal shadow was seen in the lung skiagrams. This indicates enlargement of the tracheo-bronchial and paratracheal glands which may be taken to represent the last line of defence before the invasion of the blood stream. In the more severe cases, so was the widening more apparent. Their appearance, even in healed cases, must be a warning of the probability of further dissemination. Also the greater the enlargement, the more probable is the reinfection

to be massive than minimal. Should they not be apparent, it seems permissible to consider the future more hopefully.

There was evidence of tuberculosis elsewhere than in the lungs in seven of the records; lesions involving the bones were most prominent, although the kidneys, the testes, the skin and the eyes did not always escape. In the older cases, there was a history of recurring outbreaks of tuberculous disease in remote parts of the body over a period of years. This affords strong evidence in support of the theory of the haematogenous dissemination of the original deposits. It seems highly probable that a miliary deposition of bacilli, with the formation of tubercles, preceded the remote lesion. Intimal tubercles were formed in the pulmonary veins to give rise, after ulceration, to a systemic infection. Such a process may frequently take place without its radiological detection being possible, the tubercles in the lungs being so small as to escape notice. Harbitz (43) reported a case of acute miliary tuberculosis where the lesions in the lungs at autopsy, were visible only microscopically.

It has been suggested that chronic miliary tuberculosis is a manifestation of a prolonged secondary stage of Ranke. (1)(6)(14). It is the stage of 'chronic haematogenous dissemination' which frequently escapes recognition. That it occurs commonly at this stage is probable, but there seems to be no reason for its not appearing at any time when a haematogenous dissemination of tubercle bacilli occurs,

especially as it is frequently seen in later life.
(vide cases 6 and 7.)

According to Saye(38) a miliary tuberculosis of the primary infection may occur when the bacilli gain entrance to a blood vessel. Here pulmonary symptoms are evident and the signs are those, usually, of a bronchopneumonia. He points out that, if recovery takes place, calcified foci may be seen in the lung fields. Case 1 has appearances suggestive of such an origin, but the presence of enlarged hilar glands at an early stage of the disease are presumptive evidence of reinfection.

It has been previously suggested that the greater the enlargement and caseation of the mediastinal glands, the more severe will be the pulmonary infection and the more likely the tendency to recurrence. The ultimate results of pulmonary invasion seem, however, to be by no means constant. That it is aborted, in many cases, is highly probable. It has been seen to disappear radiologically, at least, within six months. It sometimes remained with dense fibrosis and even calcification of the miliary tubercles. In two of the cases of long standing, cavitation was seen, suggesting a possible genesis of fibrocaseous disease in the coalescence of chronic miliary tubercles. Burton Wood (9) had the opportunity of observing such a process taking place in a boy, over a period of eight years.

None of the cases in this series presented appearances compatible with the theory of lymphatic dissemination. That a lymphatic spread occurs, after blood infection, is not questioned. Since authorit-

authorities as noted as Burnard and Assman quote authentic cases of this type, it demands consideration. It involves the retrograde passage of the infection along the lymphatics and the deposition of miliary tubercles at the points of attachment, and giving rise to the characteristic appearance of lymphangitis reticularis. Its benign nature is in keeping with tuberculosis of the lymphatic system. Lindau suggests that it is a type of benign lymphogranuloma. It appears, however, to be a quite separate etiological entity and to include it as a variant of chronic miliary tuberculosis is to add confusion to an already difficult etiological problem.

It is realised that it is not possible to generalise on an analysis of only a few cases. But there is presumptive evidence to conclude that the more intensive is the primary lesion, the more probable is the incidence of miliary tuberculosis; a recommendation, in spite of one disaster, for the extended use of B.C.G. vaccination. All that will render the primary infection not only inapparent clinically but anatomically minimal must be used to prevent the disastrous consequences of the primary lesion.

It is not intended to imply in this thesis that chronic miliary tuberculosis is a constant clinical syndrome but rather as an important clinical manifestation of a tuberculous bacillaemia, all stages of which are seen from the acute to the healed with their remote effects. Its very versatility

recommends it as a field for further research not only for enquiry into its own difficult aetiology but with the probability that it might provide the stepping stone to a clearer understanding of the nature of the more ubiquitous and therefore, more urgent tuberculous states.

Summary and Conclusions

1. That chronic military tuberculosis is a chronic variant of acute military tuberculosis, the type being determined by the nature of the individual immunity to the tubercle bacillus.
 2. That the military dissemination in the lungs is a sequel to a bacillaemia of the blood from the right side of the heart.
 3. That a military implantation of tubercle in the lungs may be abortive both clinically and radiologically.
 4. That, owing to the necessity for X-rays in diagnosis, the condition may be frequently missed and consequently much commoner than previously thought.
 5. That a military dissemination of tubercle bacilli may precede the majority of remote tuberculous lesions.
 6. That the persistence of chronic military tubercles may be responsible for the onset of fibro-caseous disease by coalescence of the adjacent tubercles.
 7. That a persistent widening of the upper mediastinal angle in the lung skiagram is suggestive of probable further reinfection even in adults.
 8. That the formation of abscess in a remote focus is not an unfavourable sign and that some therapeutic substance which favours healing, may be present in 'tuberculous pus'.
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